ITS Sheet 9

Electronic Toll Collection

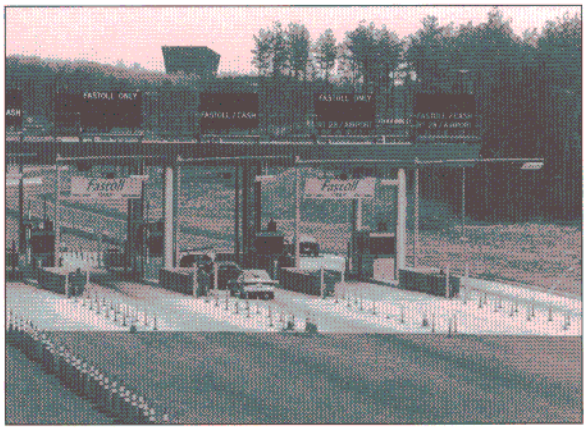
NATIONAL ASSOCIATIONS WORKING GROUP FOR ITS

Innovative Toll Collection Systems Pay Off for Motorists and Agencies

Electronic systems are rapidly replacing traditional stop-and-pay toll booths for roads, bridges, tunnels, and ferries worldwide. A recent survey[1] of major metropolitan areas in the United States found that 91 percent of toll plazas had electronic, drive-through capability. How do these systems work? Radio devices called transponders, mounted in or on the vehicle, carry coded information that tells the system which account to debit or bill. As the vehicle travels through the toll plaza, an antenna-like device in the pavement or along the road "reads" this data into the system. Additional information, such as type and weight of vehicle, can also be collected.

Electronic toll collection (ETC) systems offer important benefits:

- **Speed.** Less congestion at toll plazas, better fuel economy, less pollution.
- **Efficiency.** No more fumbling for change or tracking receipts. Tolls are debited from motorists' escrow accounts or billed to motorists, simplifying recordkeeping for customers and toll facility operators.
- **Savings.** Toll facility operating costs are lower. Smoother, safer traffic flow often encourages more motorists to use the facility. These benefits can lead to faster payback on construction investment.



Improved ETC technologies promise more flexibility and new uses. Standardization and regional integration with other intelligent transportation systems can offer interoperability, multimodal applications, variable pricing capabilities, and "cross-talk" with traffic management systems.

Geographic interoperability. Regional interoperability streamlines travel for the motorist. Independent toll facilities are working together in consortiums to provide travelers streamlined travel throughout a region and to benefit from cost-sharing economies, for example:

- In the Northeast, E-ZPass interoperability has extended through 14 toll authorities to seven States.
- Florida's SunPass and central Florida's E-PASS systems are now both accepted on all major toll roads and bridges in the State.

Commercial vehicle operations integration. Tags used for ETC have the potential to further streamline transport of goods and people. By accessing stored vehicle-specific and driver-specific information, the toll tag can serve as a commercial driver's license or as a smart vehicle card. Systems can carry the numerous Federal, State, and local credentials required to operate a truck or bus in interstate commerce, as well as maintenance and fuel use records. Automating these administrative functions would reduce the burden for State and local agencies and for fleet managers and drivers, while enhancing security and roadside screening and inspection.

Multimodal and multipurpose uses. The toll tag also has potential for multiple applications. Some ETC systems already allow motorists to pay parking fees through their toll account. The devices can serve as a common medium for paying fares on urban transit systems, accessing restricted buildings or areas, or making retail purchases. A Federally-funded project in Orlando, Florida, is building a regional system that will integrate electronic

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collection of bus and rail transit fares, highway tolls, and parking fees. A pilot program in Long Island, New York, allows motorists to purchase fast-food in McDonald's drive-through lanes with E-ZPass. Multiple applications offer opportunities to influence travel demand and encourage multimodal travel, while reducing transaction costs for cooperating agencies.

Variable pricing. Electronic tolling systems have the potential to support variable pricing, sometimes referred to as "congestion pricing" or "value pricing"—where tolls vary by time of day or level of congestion. Higher tolls are usually charged when congestion is heaviest to encourage peak period users to shift to off-peak periods, HOV modes, transit, or less congested routes. Congestion charges can create incentives for more efficient use of existing capacity, provide indicators of need for expansion, and generate revenues to support improved mobility. Variable pricing could include optional fees for access to dedicated road facilities (high occupancy toll or HOT lanes) that provide superior service and time savings compared to the parallel free facilities.

Data integration. ETC technology can feed data on traffic flow and system capacity to traffic management and traffic information systems. Vehicles equipped with transponders can act as probes to monitor traffic flow, helping authorities to detect abnormal flow and compute projected travel time along important highways. The data can be used to manage traffic (e.g., adjust signal timing or ramp metering) or to provide traveler information.

While future applications are under development, existing systems are reducing congestion and saving money for toll facility operators now. Research shows that these systems can increase lane capacity by 250 percent or more while reducing the cost of staffing toll booths by 43 percent and the cost of handling money by 10 percent (see www.benefitcost.its.dot.gov). Similar benefits have been demonstrated in many systems, for example:

- On the Maine Turnpike, 30 percent of all commuters use the electronic system. As a result, the cost of toll collection has been cut by more than $4 million a year.
- ETC systems deployed at three tunnels near Baltimore, Maryland, have increased average through-traffic speed by 56 percent.
- On Florida's Orlando-Orange County Expressway, dedicated electronic tolling lanes process more than 1,800 vehicles per hour—compared to 380–680 vehicles per hour in other lanes—and with drive-through toll plaza speeds up to 25 miles per hour.

Electronic systems are paying off for motorists as well in efficiency and convenience and, for commercial vehicle operations, in more cost-effective operations.

Electronic Toll Collection Technologies

Most ETC systems consist of three subsystems:

- Automatic vehicle identification subsystems use radio frequency (RF) tags attached to the vehicle to transmit customer data to in-lane antennas or readers linked to the toll transaction-processing database. Most of the RF tags in use relay customer identification numbers only, although more sophisticated "smart tags" are gaining popularity. Smart tags accommodate fixed data (notably customer and vehicle information) and updateable data (such as information on where the vehicle entered the system and the customer's account balance).
- Automatic vehicle classification subsystems consist of sensing devices, which detect the physical characteristics of vehicles using the ETC system, and a processing unit, which interprets the data, assigns a vehicle "class" to the transaction, and passes the information to the toll transaction-processing database. Sensing devices may include inductive loops, treadles, weigh-in-motion scales, light beams and light curtains, and video image processors. Vehicles are typically classified as cars, trucks, or buses.
- Video enforcement subsystem technologies capture and process digital images of the license plates of any vehicles that are in the ETC lanes without valid RF tags. All vehicles in the ETC lanes are captured on video, but only vehicles identified as violators have their images digitized, processed, and stored. The processed images are forwarded to a review center, where plate numbers are matched against motor vehicle records to identify vehicle owners.

1. "Tracking the Deployment of the Integrated Metropolitan Intelligent Transportation Systems Infrastructure in the USA: FY99 Results." U.S. Department of Transportation, March 2000 (Document No. FHWA-OP-00-016, available from the National Technical Information Service, Springfield, Virginia 22161).

For more information...

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U.S. Department of Transportation

Publication No. FHWA-OP-001-029

Produced by the Federal Highway Administration and the Federal Transit Administration for use by members of the National Associations Working Group for ITS